clearly set forth, and illustrated by numerous experiments and well-drawn diagrams. Its weak point, if it has a weak point, is that it is a little too didactic and not sufficiently suggestive. There is little to stimulate the student to ask himself or other people questions relating to what he has read, which may be partly due to the rather crowded mass of information. To take one example, the action of steam on various metals is described; some react and others do not. No comment is made or question raised as to the reason of this remarkable difference, and the student must be satisfied with the bare fact. J. B. C.

OUR BOOK SHELF.

The Theory and Practice of Bridge Construction in Timber, Iron and Steel. By Morgan W. Davies. Pp. viii+594. (London: Macmillan and Co., Ltd., 1908.) Price 12*s.* net.

THIS work is based upon notes of lectures delivered by the late Mr. Davies to students of civil engineering at the Swansea Technical College, and the aim the author had in view was to collect together a series of easily understood rules to enable problems of bridge design to be solved by graphical and analytical methods. The first two chapters are devoted to the routine problems connected with the bending moments and shearing forces of simple and built-in beams; then follow a series of chapters on stresses in the bars of framed structures; all the trusses which have been generally used in bridge construction are considered; in some cases graphical methods are employed, and in others, such as lattice girders and bow-string girders, analytical methods.

Special chapters are devoted to such subjects as the moment of resistance of beams, the strength and fatigue of iron and steel, the strength of columns, and the design of riveted joints. The various rules which have been proposed for fixing the working stresses in the different members of bridges are given, and their justification discussed; the recent failure of two long-span bridges in America emphasises the importance of this subject, and bridge engineers will be hardly likely in future to be any more enamoured of the rules laid down by certain well-known American bridge designers for the working stresses in struts than they have been in the past. The design of arches is very fully dealt with in chapter xiii.; both masonry and metallic arches are treated of, though, as is usual in text-books, much more space is devoted to the latter; this chapter will be one much consulted by the student, who generally finds more difficulty in determining the stresses in metallic arches, and in selecting suitable forms for the different members, than he does when dealing with ordinary trusses; the methods adopted by the author are clear and concise.

This chapter is followed by three which treat of suspension bridges, opening or draw bridges, and traversing or transporter bridges, and then by a chapter full of useful practical details on various types of bridge flooring, piers, and bolsters, or shoes, for distributing the pressure uniformly to the bearing plates. In the last chapter the author has worked out several complete examples of bridge design in order to illustrate the principles he has laid down in the earlier chapters; these examples include timber trestle bridges, highway bridges with steel main girders, a plate girder railway bridge, and, lastly, a Murphy Whipple truss railway bridge of 100-feet span. These examples will be of considerable service to the young designer and to the student.

T. H. B.

Metallic Alloys: their Structure and Constitution. By G. H. Gulliver. Pp. xv+254; illustrated. (London: C. Griffin and Co., Ltd., 1908.) Price 6*s.* net.

THE study of metallic alloys is a "practical" subject. Many alloys were discovered long ago by accident, and the development of their manufacture and use is based on empiricism. Even the recent introduction of a number of other alloys has owed little to theoretical considerations, and no attention is paid to predictions as to the properties of untried combinations. There is plenty of experimental evidence to be classified and discussed, but the time has hardly come for the logical method of treating the subject adopted by Mr. Gulliver. At any rate, the book would have been better balanced if more attention had been paid to the experimental data.

The author has adopted the classification of alloys presented by Roberts-Austen and Stansfield at the Congrès international de Physique in 1900. This classification was based on Roozeboom's study of equilibrium in mixtures, but the author has amplified it in many respects, and with its aid has been enabled to present a tolerably complete theory of alloys on a systematic basis. He has consistently applied the name "solution" to any physical mixture of metals, liquid or solid, and there is doubtless no disadvantage in this way of regarding them, though it has not much claim to be considered as a "method of study." One of the difficulties in applying the solution theory to alloys in practice is that equilibrium is not established in solid mixtures in any reasonable length of time under ordinary conditions. The alloys used in the industries are generally in an unstable state, and when equilibrium has been established in them it often happens that their usefulness has departed. This is, of course, one of the reasons why the recent study of alloys has not thrown more light on their useful properties.

The book, taken by itself, will not be of much use to engineers or manufacturers. It is not even quite what is wanted for students, but it may be recommended to their teachers. The weakest part of the book is that devoted to methods of investigation, which could have been made to afford much more help to those engaged in research. Its greatest claim to be read is that it gives a more complete classification of alloys than has hitherto been available.

(1) *Ex-meridian, Altitude, Azimuth, and Star-finding Tables.* By Lieut.-Commander Armistead Rust, U.S. Navy. Pp. li+393. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1908.) Price 21*s.* net.

(2) *Nautical Charts.* By G. R. Putman, Director of Coast Surveys, Philippine Islands. Pp. viii+162. (Same publishers, 1908.) Price 8*s.* 6*d.* net.

(3) *A Text-book of Theodolite Surveying and Levelling.* By Prof. James Park. Pp. x+216. (London: C. Griffin and Co., Ltd., 1908.) Price 6*s.* net.

(1) THE author has gathered together a very useful set of tables and diagrams for finding the latitude, facilitating the plotting of lines of position, and giving new and practical methods for identifying stars in cloudy weather. The tables extend from lat. 0°–65° and declination 0° 71′ north and south. The book is excellently printed and arranged; full descriptions of how to use the tables are given, together with examples. It should prove most useful to the mariner, as its scope covers practically all the navigable portions of the globe.

(2) This small volume, which deals with the methods of the U.S. Surveying Service, gives a very good general idea of how the work is carried out

from the time of commencing the survey until the chart has been produced ready for issue. It contains good descriptions of the various sorts of charts used by seamen, together with much useful information on how to use them in a proper manner. The book is divided into eight chapters, each one dealing with a separate subject; it is well illustrated, and is a valuable addition to books dealing with hydrographical surveying.

(3) A very useful handbook dealing with general surveying work, levelling, railway curves, and mine surveying; each branch of surveying is well described, and accompanied by diagrams and practical examples collected from actual field experiences. It is a book which should prove as useful to the professional surveyor as to the student. H. C. LOCKYER.

Penrose's Pictorial Annual: a Review of the Graphic Arts. Vol. xiv., 1908–9. *The Process Year Book.* Edited by William Gamble. Pp. viii+208. (London: A. W. Penrose and Co., Ltd.) Price 5*s.* net.

IN directing our readers' attention to the annual volumes of this publication, we have year by year pointed out the very excellent nature of the contents and the very high state of efficiency which it has attained. So much care has been bestowed on the reproduction methods, the inks employed, and the other materials used that it seemed nearly impossible that any very conspicuous advance could be made except after the lapse of a few years.

Yet in the volume before us we have a proof that such an assumption is incorrect, for one has only to look through the present issue to see how marked the progress made has been since the last volume was issued to the public. Even the editor, in his preliminary remarks, writes:—"We can hardly realise ourselves how it is possible to continue improving on these mechanical processes as has been shown each year, yet here again is the evidence of the possibility, and one is inclined to wonder what further marvels the future has in store for us."

With such a wealth of text and illustration included in this volume it is difficult to name any one feature which is more conspicuous than another. The editor commences, as usual, with his summary of the year's progress in process work, and this is followed by a great number of articles on various branches of the subject by well-known workers. The illustrations, which are, of course, the chief feature of this publication, demonstrate, more than words can do, the excellence of the reproduction processes that are now available. All kinds of subjects are dealt with, from the reproduction of an old master to illustrations for boot catalogues, and these suggest the best kinds of process work for the particular subject to be dealt with.

Perhaps enough has been written to indicate that if anyone wishes to make himself acquainted with the results of process-work of to-day he cannot do better than obtain this handsome and moderately-priced volume. The editor and his co-workers deserve high praise for placing such a useful and valuable publication within easy reach.

The Edinburgh School Atlas. 32 plates. (Edinburgh and London: W. and A. K. Johnston, Ltd., n.d.) Price 1*s.*

A WIDE popularity may be predicted for this remarkably cheap atlas. The maps are clear, uncrowded, and entirely orographical. There is a good general index showing the latitude and longitude of places included in the maps. It is gratifying to find that geographical publishers are acquainting themselves with modern needs and producing maps which will assist greatly teachers of geography who adopt scientific methods in their work.

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.]*

The Product and Rays of Uranium X.

FROM the present state of the subject it is clear that there is one, at least, and that very probably there are two, intermediate products between uranium X and radium giving α rays on disintegration. The direct parent of radium has recently been shown by Boltwood (*Amer. Journ. Sci.*, 1908, xxv., 377) to give α rays of characteristic range. Between the atomic weight of uranium and radium there is a difference of twelve units, corresponding to the expulsion of three α particles, of which only two, that from uranium and that from the parent of radium, so far are known. It is true there is a disposition to regard it as probable that the change of uranium into uranium X is accompanied by the expulsion of two α particles, as Boltwood (*loc. cit.*, p. 285) has shown that the contribution of uranium in minerals to the total α radiation of the mineral is about twice that of any of the succeeding products.

My recent result on the rate of production of helium from uranium (NATURE, December 3, 1908, p. 129) is against this view. In the thorium series—thorium → meso-thorium → radio-thorium → thorium X—complete chemical similarity occurs between the *alternate* pairs—thorium and radio-thorium, meso-thorium and thorium X—no chemical separation of these pairs having yet been found possible. If the hypothetical product of uranium X similarly was chemically analogous to uranium and gave α rays, the result obtained by Boltwood for the α radiation of minerals might perhaps be explained. In the present state of the subject there is hardly sufficient evidence that the number of α particles expelled by uranium is exceptional. Further evidence on the question whether an intermediate body exists between uranium X and the parent of radium may be expected so soon as the uranium preparations we have had for many years under observation in this laboratory begin to grow radium, as the power of the time which the rate of growth follows gives an indication of the number of intermediate stages. Already the results show that if there is not such a body (or bodies) the period of the parent of radium is at least six times as great as that of radium (*Phil. Mag.*, October, 1908, p. 636).

In the meantime I have attempted—so far without complete success—to detect the growth of an α-ray product from very active preparations of uranium X prepared from large quantities of uranium. I have established that there is a feeble residual α radiation remaining from all my uranium X preparations after the β radiation has decayed, and this residual activity *then remains constant.* The residual α activity of a preparation of uranium X some four or five years old has been kept under careful observation for nine months, and no change of activity has been detected. Newer preparations have shown that the α radiation has a practically constant value before the β rays have all decayed, showing that if the α-ray body is a real product of uranium X it must be the *direct* product. The attempt to follow a growth of the feeble α activity simultaneously with the decay of the intense β activity, which the latter view demands should occur, has so far been delayed by the β rays showing unexpected properties. I have not yet succeeded in establishing a genetic connection between the α-ray body and the uranium X, so that all that can at present be said is that the results are not opposed to the view that the direct product of uranium X may give the missing α ray of the series, and prove to be the parent of the parent of radium.

With regard to the β rays of uranium X, these until now have been regarded as homogeneous, with a value for $H\rho$ of 2000; but I have found that in a magnetic field twice as strong as that required to prevent β rays having the value 2000 from entering an electroscope, 5 per cent. of the total effect of the β rays still persists. Even in much stronger fields, using sufficiently active preparations of uranium X, the effect of the β rays is still marked. It